California Regional Water Quality Control Board
Santa Ana Region

March l 2, 2004

Item: 22

Subject: **RESULTS OF ANNUAL WATER QUALITY SAMPLING FOR THE YEAR 2003 – SANTA ANA RIVER BELOW PRADO DAM**

Summary:

The Basin Plan specifies water quality objectives applicable to Reach 3 of the Santa Ana River (River). To determine compliance with these objectives, the Basin Plan requires that sampling of the River be conducted annually at Prado Dam during baseflow conditions.

Regional Board staff conducted the year 2003 sampling over a four-week period during August and September. The results of the year 2003 sampling program indicate that the River at baseflow is meeting Basin Plan objectives for all constituents.

Stream flow at Prado Dam during the sampling period ranged from 177 to 203 cubic feet per second (cfs) and averaged 193 cfs.

Background:

The Santa Ana River is the major source of recharge to the Orange County groundwater basin. The Basin Plan specifies certain water quality objectives applicable to Reach 3 of the River (Mission Boulevard in Riverside to Prado Dam) during base flow. The intent of these objectives is to protect the River's groundwater recharge beneficial use. Compliance with these objectives is verified by annual measurement of the base flow quality. Base flow is composed of wastewater discharges, non-point source discharges and rising ground water. Storm flow is not a component of base flow; therefore, the River is sampled during the time of the year (August or September) when the influence of storm flow is at a minimum.[1]

Methods:

The sampling program was carried out weekly during the months of August and September 2003. Each week, an ISCO sequential sampler was deployed to automatically collect a 24-hour composite sample from the River. The composite sample was then analyzed for mineral analyses, including total dissolved solids (TDS), chloride, sodium, sulfate, boron, and hardness. In addition, three grab samples were collected during the 24-hour period and analyzed for nutrients (filtered), chemical oxygen demand (filtered COD), and total organic carbon (TOC),

[1] In setting the base flow objectives, it was assumed that storm flows that recharge the Orange County groundwater basins would improve the quality of that groundwater. It was also recognized that there could be no assurance that such storm flows would occur each year. Therefore, it was imperative to control base flow quality such that under these worst-case conditions (no high quality storm flows), Orange County groundwater quality would remain protected.

and electrical conductivity in unfiltered samples. The Regional Board's contract laboratory, E.S. Babcock and Sons, Inc., performed all the analyses for this study.

Stream flow measurements were obtained from the U.S. Geological Survey after the sampling program was completed.

Orange County Water District (OCWD) also conducts an independent water quality monitoring program in the Santa Ana River consisting of weekly sampling in the river and its tributaries. Regional Board staff used OCWD's data from the sampling performed during the months of August and September 2003 to compare and confirm the Prado Dam results.

Results and Discussion:

2003

The grab sample results are tabulated in Table 1. The total nitrogen concentrations ranged from 5.3 to 6.1 mg/l, with an average concentration of 5.8 mg/l. These results are significantly lower than the Basin Plan objective (10 mg/l). COD concentrations ranged from 10 mg/l to 13 mg/l, with an average concentration of 11 mg/l. All COD concentrations were below the Basin Plan objective of 30 mg/l.

TOC is a direct measurement of the organic content in water. TOC was added to the annual sampling program in 1989 because the California Department of Health Services (DHS) has proposed specific TOC criteria when reclaimed water is used to recharge groundwater. DHS has not finalized the groundwater recharge regulations; however, the latest draft provides TOC guidelines for the Santa Ana River recharge activities. When 46 – 50% reclaimed water is used in surface spreading, the draft regulations specify a maximum allowable TOC of 6 mg/L. Once the guidelines become regulations, it is anticipated that a TOC objective may be recommended for incorporation into the Basin Plan. For the 2003 TOC analyses, the laboratory inadvertently filtered the samples collected on August 20, 26, 27, and September 2, and 3, 2003. The filtered TOC results are reflected on the table in bold font. The average TOC concentration was calculated using only the unfiltered samples in order to allow comparison with previous years' calculations. The TOC concentrations in the River ranged from 4.3 to 5.8 mg/L with an average concentration of 5.0 mg/L.

The Prado Dam results for August and September 2003 for the mineral constituents are tabulated in Table 2. The results indicate that all mineral concentrations were below their respective Basin Plan objectives. Of particular interest are the total dissolved solids (TDS) results, which ranged from 580 mg/l to 650 mg/l and averaged to 602 mg/l. These results indicate that the TDS concentrations are well below the Basin Plan objective of 700 mg/l; however, TDS concentrations in the 2003 baseflow period increased from last year's average of 497 mg/l.

Average values of Orange County Water District's (OCWD) data are tabulated in Table 3 for Reach 3 of the Santa Ana River, Santa Ana River below Prado Dam and for several other Santa Ana River tributaries (see Figure 1). OCWD results for the Santa Ana River below Prado Dam

are comparable to the results obtained from the Regional Board monitoring program; all parameters met their respective Basin Plan objectives.

1983 –2003

Table 4 summarizes the annual averages of the various constituents along with their respective water quality objectives over time for the Prado Dam sampling program. The data indicate that the water quality of Reach 3 of the Santa Ana River for these parameters continues to improve.

Graphs depicting the 1983 – 2003 data in Table 3 for TDS and TN are shown in Figures 2 and 3 respectively.

Both TDS and TN concentrations continue to decrease from the elevated concentrations measured in the early 1980s, due to a number of factors, including improved wastewater treatment, water supply improvements and /or natural treatment through wetland facilities.

Conclusion:

The results of the 2003 Prado Dam sampling program indicate compliance with the Basin Plan objectives.

TABLE 1
SANTA ANA RIVER BELOW PRADO DAM
2003 GRAB SAMPLE ANALYSES

Sample number	Date	Time	Discharge (cfs)	pH (units)	Electrical Conductivity (umhos/cm)	Total Organic Carbon (mg/l)	Total Nitrogen (mg/l)	Chemical Oxygen Demand (mg/l)
SAR090303-1	8/12/2003	10:35	196	8.0	930	5.2	5.8	13
SAR090303-2	8/12/2003	12:35	-	8.0	930	5.8	5.7	13
SAR090303-4	8/13/2003	10:20	202	8.0	900	4.5	5.3	10
SAR090303-5	8/19/2003	10:05	206	8.1	910	4.3	6.3	10
SAR090303-6	8/19/2003	12:15	-	8.1	920	5.3	6.1	10
SAR090303-8	8/20/2003	10:15	189	8.2	940	**5.2**	5.5	10
SAR090303-9	8/26/2003	12:45	177	8.1	980	**4.9**	5.9	13
SAR090303-10	8/26/2003	14:45	-	8.2	960	**5.5**	5.7	10
SAR090303-11	8/27/2003	12:30	182	7.6	970	**5.4**	6.1	10
SAR090303-13	9/2/2003	14:00	203	7.8	950	**4.8**	5.4	10
SAR090303-14	9/2/2003	15:15	-	7.9	930	**4.5**	5.7	10
SAR090303-15	9/3/2003	1330	190	7.9	930	**4.4**	6.1	10
AVERAGE	-	-	*193*	*8.0*	*938*	*5.0*[2]	*5.8*	*11*
Basin Plan Obj.	-	-	-	*8.5*	-	-	*10*	*30*

[2] Average concentration for unfiltered samples collected on 8/12, 8/13 and 8/19

TABLE 2

SANTA ANA RIVER BELOW PRADO DAM
2003 MINERAL ANALYSES

Sample number	Date	Sample Type	TDS (mg/l)	Boron (mg/l)	Hardness (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Sulfate (mg/l)
SAR090303-3	8/13/2003	Composite	600	0.26	260	89	100	88
SAR090303-7	8/20/2003	Composite	650	0.28	260	93	110	99
SAR090303-12	8/27/2003	Composite	580	0.3	280	96	110	98
SAR090303-16	9/3/2003	Composite	580	0.29	280	98	110	96
AVERAGE	---	---	*602*	*0.28*	*270*	*94*	*108*	*95*
Basin Plan Obj.	---	---	*700*	*0.75*	*350*	*110*	*140*	*150*

Table 3
Orange County Water District Santa Ana River Data – Average Values
(Weekly samples collected from August 5 to September 16, 2003)

Sampling Location	pH (units)	Sodium (mg/l)	Total Dissolved Solids (mg/l)	Total Nitrogen (mg/l)	Total Organic Carbon (Unfiltered) (mg/l)	Unfiltered Chemical Oxygen Demand (mg/l)	Chloride (mg/l)
CHINO CREEK	8.12	77.9	431.2	4.0	5.8	13.0	96.1
MILL CREEK	9.88	92.7	430.0	5.4	8.9	23.0	93.0
TEMESCAL CREEK	8.48	70.4	154.0	6.0	4.4	16.0	85.0
SAR-BELOW DAM	8.32	96.9	557.0	5.0	4.9	24.8	108.6
SAR-RIVER RD	8.42	91.1	194.4	7.4	3.1	8.0	100.8
SW-RP2 MILL CREEK	8.74	105.2	461.6	4.0	7.9	18.0	105.7

Table 4

Santa Ana River Base Flow Results for 1983 – 2003 Averages

Year	Discharge (cfs)	TDS (mg/L)	Total Hardness (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Boron (mg/L)	Total Nitrogen (mg/L)	COD (mg/L)	TOC (mg/L)
1983	213	716*	356*	91	85	NA	0.30	8.2	86*	NA
1984	128	683	350*	96	116	159*	0.40	7.3	58*	NA
1985	138	682	339	96	115	150*	0.33	9.8	33*	NA
1986	123	656	290	98	110	127	0.25	10.2*	43*	NA
1987	132	641	323	97	97	134	0.45	10.2*	27	NA
1988	134	629	297	102	111	130	0.25	10.3*	38*	NA
1989	127	635	290	102	115	128	0.30	10.2*	31*	9.9
1990	131	640	289	107	117	128	0.36	11.9*	26	9
1991	124	648	281	89	101	114	0.36	10.9*	18	5.3
1992	136	617	282	98	110	108	0.36	10.6*	18	4.9
1993	130	672	288	99	125	128	NA	8.2	30*	NA
1994	119	629	286	101	114	140	0.38	8.6	40*	5.5
1995	141	636	276	91	103	104	0.28	7.5	27	4.8
1996	168	578	250	88	97	106	0.27	9.5	22	5.4
1997	149+	607+	218+	89+	99+	112+	0.36+	6.3+	NA	9.7+
1998	245	524	264	85	96	100	0.30	7.4	30@	4.7
1999	190	586	271	99.5	101	110	0.341	6.3	30*	4.8
2000	186	562	251	105	107	105	0.321	6.7	15.47	4.7
2001	192	631	276	96.7	109	99	0.334	6.08	14	5.1
2002	356	497	228	97.0	103	92	0.317	4.32	13.9	6.1
2003	193	596	254	94.2	108	93	0.28	4.8	12.6	5.0#
Basin Plan Objective		*700*	*350*	*110*	*140*	*150*	*0.75*	*10*	*30*	-

*Value equals or exceeds Basin Plan Objective
N/A Not analyzed
+1997 Calculated results
@value is for unfiltered sample not to be compared with COD Basin Plan Objective
average of only 5 samples

Figure 1
Map of Orange County Water District's Sampling Locations

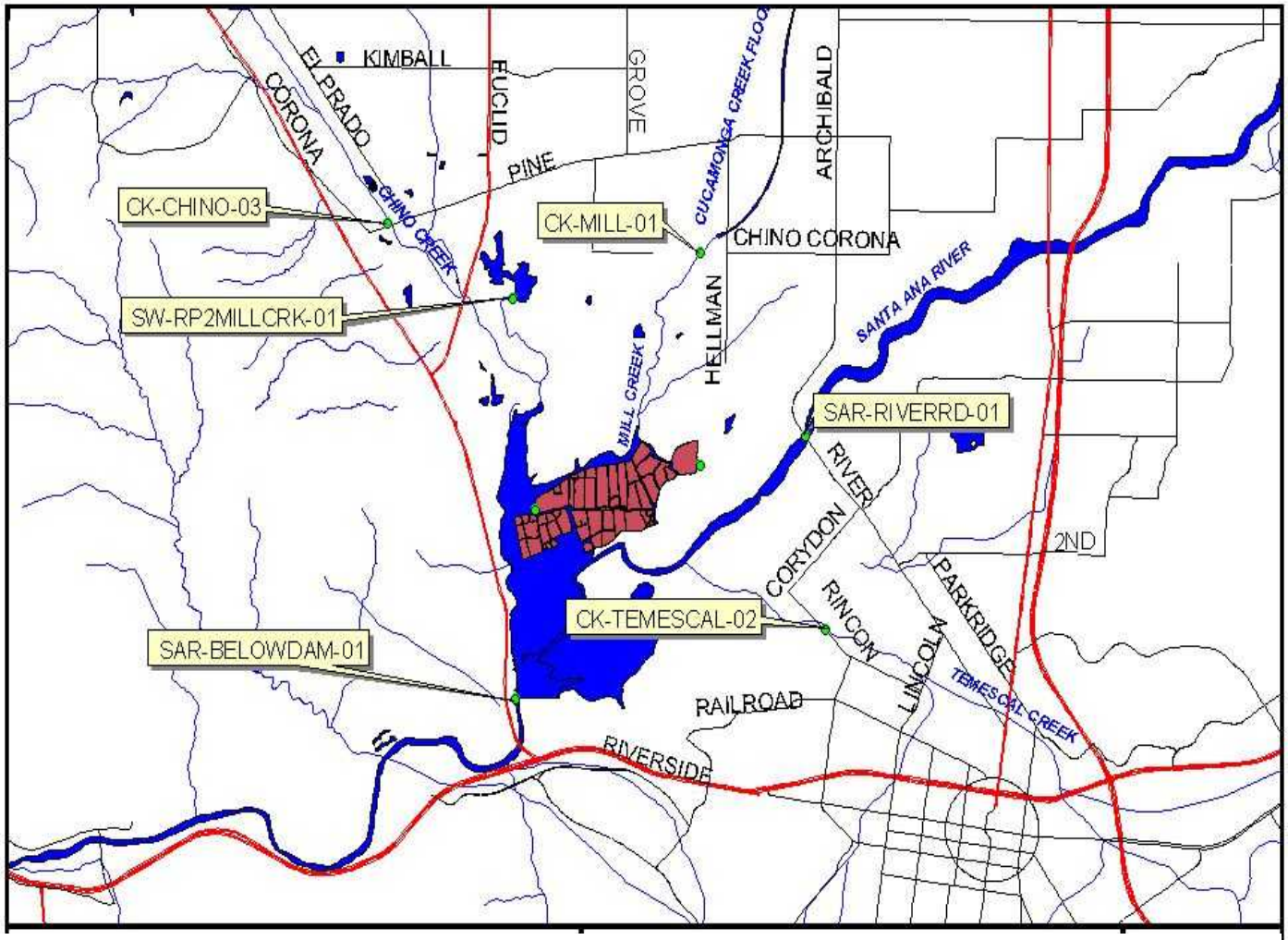

Figure 2
TDS from 1983 - 2003 Santa Ana River Reach 3 Below Prado Dam

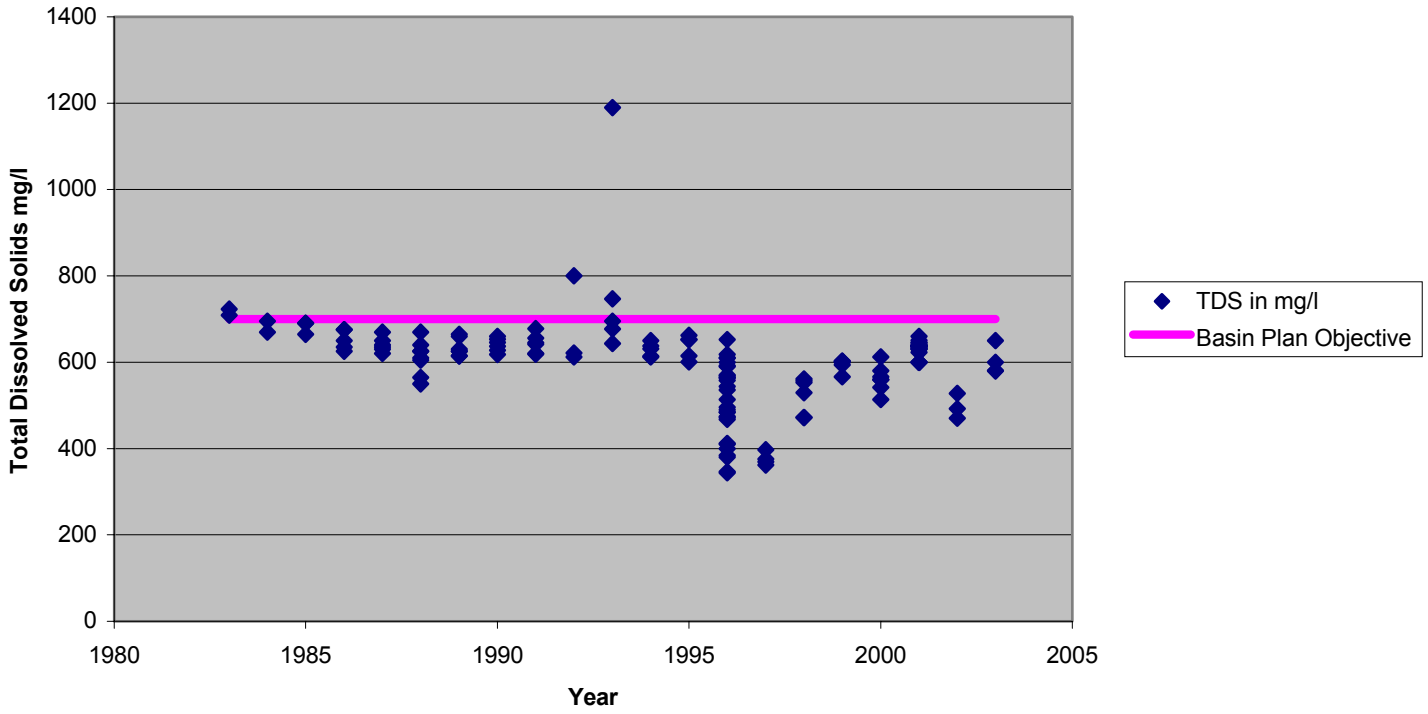

Figure 3
Total Nitrogen from 1983 - 2003 Santa Ana River Reach 3 Below Prado Dam